ENGR 12L Final Project Circuit Demo

The final project is a chance to consolidate your understanding of circuits by building and testing an electronics project of your own choosing. This is a great opportunity to shift your focus from meeting the requirements of the course to meeting the needs of your own personal career or technical objectives.

Electronics projects can take many hours to complete, so the challenge here is to find something that can be completed in approximately 3-6 hours of time. You can bring your lab kits home to work on your project, but you'll need to bring them back each week to do the labs. You should also be able to complete the project during available lab time (after completing the main lab objectives) and/or dropping in on one of the STEM sessions.

You should be able to build your project on a portion of your breadboard, leaving the remainder of your breadboard open for Labs 13-15. For safety reasons, you should also plan to **disconnect power wires** going to your project when you are working on another lab circuit elsewhere on the breadboard.

You can if you wish buy a standalone kit so you can take your project home with you when you are finished.

Deliverables

Item	Description	Due Date	Points
Project Proposal	1 paragraph description of the project you are choosing, your partner (optional, max of 2 people per project), and any extra parts you will need (you will have to purchase these on your own).	5/9	5
Project Report	1-2 page writeup of your project, with a schematic, at least 2 photos, and optional video links. The report must have a Title, Introduction, Body, and Conclusion (that's at least 3 paragraphs of writing). It will go into an online gallery of student work to show future ENGR12L students, so make it look good. The report must be saved in PDF format for easy web posting, with all schematics, images and/or video links contained inside (no separate files).	6/3	45
	Total Points		50

Upload both files (project proposal and project report) to the ENGR12L lab turn in link

Project Ideas

The following is a list of possible project ideas. Most of these can be constructed using the components in your lab kit. Some of them may require purchase of additional parts at Radio Shack, Potters in Seaside, or online (Digikey, Sparkfun, RobotStore, and AdaFruit Industries are four good sources of parts/projects, as is Make Magazine's MakerShed).

Final Project Ideas

1) Music Synthesizer

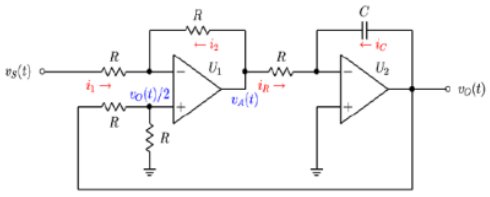
   Create a Four bit D-A converter (slides 30 and 31 of the OpAmp Lecture) and use it to convert digitally generated waveforms from the BASIC Stamp Microcontroller – a kind of crude music synthesizer. You can use four push button switches to trigger different musical notes or sounds, a potentiometer to change frequencies, and LEDs to indicate which tone is playing. Since the piezo speakers are kind of lame, you can build a driver for an 8-ohm speaker (I have a few 8 ohm speakers). This seems like a reasonable approach, requiring only a few cheap components:
   http://www.interfacebus.com/opamp-mono-amp-circuit-design-schematic.html

   OR, for the ambitious, build your own speaker using this
   https://www.radioshackdiy.com/project-gallery/turn-nearly-anything-speaker

   OR, borrow the even simpler speaker driver from the Drawdio project below.

2) Analog Computer

   Create an analog computer that solves a differential equation (see slides 79 and 80 of http://tomrebold.com/engr12/Spring14/week7/Lec7.pdf). Test your circuit by supplying various waveforms with a function generator or Analog Discovery. Compare your scope results to a MATLAB solution. Here is an example First Order solver:



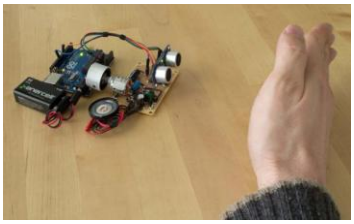
$$v_S(t) = v_O(t) + RC\frac{dv_O(t)}{dt}$$

3) Drawdio Musical Pencil

This is a novel idea: the graphite from the pencil trace changes the pitch of the sound output! By drawing different shapes you get different tones. CAUTION: the 555 chip can be a bit tricky to make work properly. https://www.radioshackdiy.com/drawdio . Includes a very simple speaker driver useful for other projects.

4) Digital Theramin

Build the instrument made famous by the Beach Boy's "Good Vibrations" hit! This digital version uses an ultrasound sensor to measure distance to your hand, and a microcontroller to do the math and produce the tone. https://www.radioshackdiy.com/index.php?q=project-gallery/theremin Substitute the BASIC Stamp for the Arduino depicted.



5) Hot-Cold LEDs

This seems fairly straightforward. It uses the ultrasound sensor plus LEDs and software to program 3 different behaviors in a robotics type sensor circuit. Substitute the BASIC Stamp for the Arduino depicted. https://www.radioshackdiy.com/diy-hot-cold-leds

6) BEAM Solar Chariots

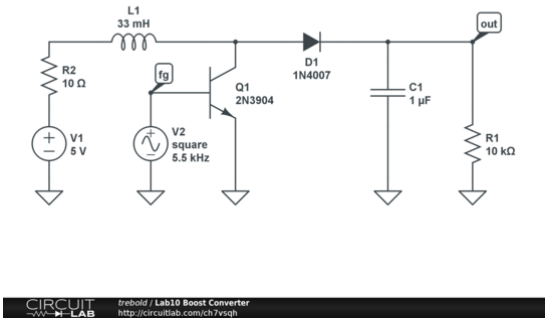
This would require substantial purchasing of parts, but it is a rewarding experience to build something that actually moves on solar power.
https://www.radioshackdiy.com/project-gallery/beam-solar-chariots

7) Persistence of Vision (POV) Display

This display takes advantage of our eyes' quirks to build a raster display out of a single row of LEDs. The LEDs flicker while you wave it in the air, and the eye sees a 2D display image. These are kits you can buy. We also have all the parts needed for this project in our lab kits. Uses the BASIC Stamp. http://shrimping.it/blog/persistence-of-vision/

8) Build a Boost Converter

This circuit generates a higher voltage DC from a lower voltage one. It uses the step response of the inductor to generate large voltage spikes, which are funnelled one-way to the capacitor, which smooths them out while driving the load R1. Similar to how commercial DC-DC converters work.



9) Build an AC-DC Converter

Want to plug something into the wall power and run a DC device? This circuit will do that for you. Make sure you include a fuse!! http://www.edaboard.com/thread169465.html